of the mineral is greater or less than that of the balsam. It then follows that $t \pm d'$ is the thickness, as seen through itself, of the amount of balsam of the same real thickness as that of the mineral: the effects of the balsam below and above it, and of the covering-glass, being thus entirely eliminated. If, then, the index of the balsam be m, we can easily calculate that of the mineral (μ) from the following equation:—

$$\mu = m \frac{t \pm d'}{t}.$$

In the case of the hard and brittle balsam used to fasten down the specimen, the value of m is about 1·54; but if there be any doubt about the true index, it can be ascertained by special measurements.

In a similar manner we may determine the index of some unknown mineral by comparing it directly with some other mineral lying near to it, the true index of which is either well known or has been previously ascertained from special measurements. For this purpose quartz is often very suitable, since its index varies very little. One great advantage of this method is that specimens may be observed far away from the edge of the section, provided of course that the minerals compared are so close together as to prevent any error due to unequal thickness in different parts.

It must be borne in mind that, when any mineral has a very powerful double refraction, its apparent thickness, as seen through itself, varies according to the particular ray used for illumination and the direction of the objects chosen to determine the focal distances of the lower surface. There is, however, generally no difficulty in measuring with sufficient accuracy the mean apparent thickness, or that corresponding to some one image, and in calculating out the results accordingly.

In connection with this subject it may be well to call attention to a somewhat interesting fact. If we have, side by side, two substances of different refractive power, but of the same *absolute* thickness, their apparent thicknesses, *as seen through themselves*, vary directly as the velocity with which light moves in them. Indeed, strictly speaking, the determination of minerals in the manner now described depends entirely on an indirect measurement of the velocity with which light is propagated through them in different directions.

In order to illustrate the practical applications of this method, I will describe the results obtained in the case of a section of dolerite from near Glasgow, which, on an average, is about $\frac{1}{400}$th of an inch thick.

I found that the index of a colourless transparent mineral, filling up cavities between the original minerals, was about 1·48 or 1·49. This exactly corresponds with that of analcime, with which its other optical characters agree.

Another colourless mineral, also filling cavities, was found to have the indices and other characters of calcite.

A third colourless mineral, evidently an original constituent, was seen to have a comparatively feeble double refraction, and its index was found to be 1·61. Its general appearance was like that of some felspar, but this index clearly proves that it cannot be any species which contains a considerable amount of alkali, which would greatly reduce the refractive power. The index of labradorite was not previously known, but I find that it is 1·61, and therefore there can be little doubt that the mineral in the section is that species.

The section also contains a number of transparent reddish-brown crystals, their index of refraction being about 1·79. This and their other optical characters closely agree with those of the dark augite in the lava of Vesuvius.

In now concluding this short address I cannot but feel that I have been obliged to omit all allusion to many points of considerable practical importance. I have not attempted to describe the subject in such a manner as would enable any one to at once practically apply the method in all sorts of cases. I gave a somewhat full account of one branch of the subject in my address at the meeting of the Mineralogical Society at Plymouth, and entered into the more purely microscopical aspect of the question in my late address at the anniversary meeting of the Royal Microscopical Society. I propose to communicate a detailed paper to the Royal Society as soon as a correct explanation can be discovered of certain small but remarkable discrepancies between mathematical theory and observation. My chief object now is simply to point out what valuable facts may be learned respecting the nature of any mineral by looking through it with a microscope at a circular hole or rectangular grating. This is a totally different thing to magnifying the mineral itself, or to looking through the mineral at any distant object without a microscope. The success of the method depends entirely upon the optical conditions characteristic of a compound microscope. I have lately greatly improved the apparatus hitherto employed, but the examples already given will, I trust, serve to prove that, even with the less perfect appliances, it was possible to identify in a very satisfactory manner, many of the minerals met with in their microscopical sections of rocks, and thus to determine their constitution with far more certainty than heretofore.

RECENT OBSERVATIONS UPON THE PLACENTATION OF THE SLOTHS

M. JOLY has recently brought before the Academy of Sciences of Paris the results of a careful examination of the structure of the placenta of the Aï, or Three-toed Sloth (*Bradypus tridactylus*, Linn.), and proposes important changes in classification, after comparison of this structure with that of certain allied mammals.[1]

It is now six years since we contributed to NATURE a notice of the observations of M. Alphonse Milne-Edwards upon the fœtal envelopes of another member of the Edentata, the "Tamandua" Ant-eater, published by him in the *Annales des Sciences Naturelles*. This Edentate is there stated to have a "placenta discoïdal envahissant."

The sloths are literally, as Buffon described them, ruminant animals, in that they have four stomachs, but they are, at the same time, wanting in all the other characters which pertain to Ruminants proper. Linnæus, on the contrary, classed them, at first among the Primates, but afterwards among the Bruta—the "Edéntés" of Cuvier—and his example was followed by De Blainville. Cuvier placed the "Tardigrades" (*Bradypus*) at the head of the Edentata, although they possess well-developed canine and molar teeth.

It will be seen, then, that as regards the position of these animals the embarrassment of the taxonomist has been extreme, as the genus *Bradypus* has been bandied about from the Ruminants to the Primates, and from these latter to the Edentata. Latterly, however, great importance—and with good reason—has been attributed to the structure of the placenta, as affording characters distinctive of the various groups of mammals, and as giving valuable indications of their zoological affinities. The classification of the placenta by Carl Vogt, though scarce a quarter of a century old, into zonary, diffuse, and discoidal, is nowadays acknowledged to be incomplete, nay, even faulty in some of its applications; for we know now, thanks to the work of Alphonse Milne-Edwards, that if the majority of Ruminants have a multicotyledonary placenta, the camel, the chevrotain, and the *Tragulus* have, on the other hand, one of the diffuse variety. It is the same with the digitigrade Pachyderms (wild boar, &c.), while the plantigrade ones (*Proboscidea, Hyracoidea*) differ from the first in having a zonary placenta like that of the Carnivora and Amphibia (seals, &c.). In fine, although stated to be so, this organ is neither diffuse nor subdivided among any of the Edentata studied from the point of view of their placentation. Nay, more; among these animals the placenta offers, according to genera, and even according to species, differences so well marked that it is necessary, following the apposite remark of M. Alphonse Milne-Edwards, to give up seeing between the different types of Edentata affinities as narrow as those which are supposed, even now generally, to exist among them. Carus has represented the placenta of the Aï, or three-toed sloth, as being multi-lobed, but he does not give any precise information as to the number of these lobes, their structure, the extent which they occupy relatively to the membranes of the ovum, and their connection with the uterine mucous membrane [decidua?], &c.

The placenta of the Aï examined by M. Joly presented itself under the form of a veritable membranous pouch constituted by the amnion and the chorion, and garnished, on almost all its external surface, with a large number (more than a hundred) of lobes or cotyledons of more or less irregular shape and of very variable size, from one millimetre to one or two centimetres. Viewed from the external face of the placenta, these cotyledons appear, some rounded and flat, like Nummulites, others of the form and size of seeds of millet. Others, lastly, much larger, grouped in numbers together, recall by their aspect the multi-

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[1] *Comptes Rendus*, August 12, 1878.

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lobed kidneys of birds and of certain Ophidian reptiles. Cavities, more or less roomy, in which are doubtless inserted the vessels of the hypertrophied mucous membrane, are also visible on the outer surface of the fœtal placenta. But it is specially upon the internal aspect that the lobules form numerous folds exactly limited, of a thickness frequently considerable (more than one centimetre), strongly adherent to the chorion by a pretty long base, free for the most part for the rest of their extent. We can understand, then, up to a certain point, that Carus should have been able to compare this placenta with that of the ruminants, from which it nevertheless differs much, since its cotyledons are made up of full lobes, generally antiguous, and not of isolated capsules, and distant one from the other like those of the fœtal placenta in the cow, or the maternal one in the sheep.

But we are as yet more disposed to assimilate the placenta of Aï to that of the Lemuroids, notably that of the *Propithecus* of Madagascar, which has been described by M. Alphonse Milne-Edwards under the name of *placenta en cloche* or *placenta envahissant*. In Aï, as in *Propithecus*, the chorion is covered almost entirely with thick and crowded villosities, constituting a kind of vascular cushion resulting from the confluence of a multitude of irregular cotyledons. But the Aï approaches *Propithecus* not only in the structure of the placenta but also in its habits, for both are arboreal, and have a diet exclusively vegetable. Besides this the uterus of the Aï is pyriform, like that of the human female and the female of most apes, a peculiarity which, with the possession of pectoral mammœ, approximates *Bradypus* to *Propithecus*. Linnæus and De Blainville seem then to have been guided by a "kind of divinatory intuition," as it were, when they ranked the sloths of Brazil in the order of Primates, only that they ought not to be classed among the apes proper, but by the side of the *Propithecus* of Madagascar and the slow Loris of the East Indies, of which they are the analogues, or American representatives.

M. Joly finally concludes thus: By its bursiform placenta, as well as by many other peculiarities of organisation, the Aï is a Lemuroid, and not an Edentate.

Not the slightest allusion is made by M. Joly to the well-known publications of Prof. Turner upon the comparative anatomy of the placenta, and especially to a paper read before the Royal Society in May, 1873, upon the fœtal structures of that variety of two-toed sloth called by Prof. Peters *Cholœpus Hoffmanni*.

J. C. GALTON

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE Master and Fellows of Gonville and Caius College, Cambridge, have considerably enlarged the chemical laboratory of the College, and have added a small but very serviceable lecture-room, with apparatus-room adjoining. They have likewise provided a private laboratory for the Prælector. The main laboratory now accommodates fifteen students working at one time.

UNIVERSITY COLLEGE, BRISTOL.—The third session of this young institution opened on October 8. The competition for the entrance scholarships was closer than any preceding year, and the general standard of attainments higher. The engineering department of the College is now fairly started, and is almost, if not quite, unique in character, the principal engineering firms in the district having agreed to an arrangement, whereby they receive into their works the engineering students of the College for the six summer months, the six winter months being devoted to the theoretical training of the College. The number of male day students of the College has largely increased; the entries in classical and modern literature, in chemistry, mathematics, and physics, exhibiting a satisfactory increase on those of the preceding year. The attendance at the evening classes is also very large. The scientific side of the College course has been strengthened by the appointment of Mr. W. J. Sollas, M.A., F.G.S., as lecturer on geology. A course of lectures on analytical chemistry is being given by Prof. E. A. Letts, who also resumes his industrial lectures on Dyeing and Scouring at Stroud.—Mr. J. Clapham also continues his course of instruction on Textile Fabrics. A course of lectures on the Technical Applications of Electricity, by Prof. S. P. Thompson, is also announced. The morning lectures on Political Economy are this year delivered by Mrs. Paley Marshall.—Mr. L. A. Goodeve, B.A., has been appointed lecturer on Law.

SCIENTIFIC SERIALS

The American Journal of Science and Arts, September.—In an opening paper on the origin of comets Prof. Newton compares the hypotheses of Kant and Laplace, the former of which represents that these bodies are formed from the matter of the condensing solar nebula; the latter, that they have no relation with this, but were made from matter scattered through stellar space. He shows that the curve of actual distribution of the inclinations of cometic orbits to the ecliptic, agrees well with that required by the hypothesis of Laplace, if we first make reasonable allowance for known perturbations, and for the comets of short periods, but that it is not thus made to agree with Kant's hypothesis.—Prof. Gray explains the distribution of tree species in North America, and traces similar species dispersed over widely-separated continents to a polar centre, where they once flourished in a temperate climate. Among other facts he mentions that while the Atlantic American Forest has almost three times as many genera and four times as many species of non-coniferous trees as the Pacific Forest, it has slightly fewer genera, and almost one-half fewer species of coniferous trees.—Prof. Marsh describes a new pterodactyl from the Jurassic of the Rocky Mountains.—Professors Draper and Watson give their observations on the solar eclipse, and an intra-Mercurial planet respectively.—The animal of *Millepora alcicornis* is figured by Mr. Rice, who confirms the conclusions of Agassiz.—Prof. Verrill notes some additions to the marine fauna of the east coast of North America; and among chemical notes is one on antimony tannate, by the Misses Swallow and Palmer.

Journal de Physique, September.—Some experiments showing the power of a vibratory motion to produce decomposition of explosive liquids and ebullition of superheated liquids are here described by M. Gernez. They consist in rubbing with a damp cloth a clean glass tube containing, *e.g.*, supersaturated seltzer water that has been kept in it for months, or a little nitrous acid below water, or methylchlorhydric ether. In the two former cases there is a projection of liquid; in the latter, a vigorous boiling occurs but soon ceases, owing to the consumption of heat by the vapour formed, reducing the temperature to near the normal boiling-point.—M. Cornu gives an account of his valuable researches on the ultra-violet solar spectrum, which have from time to time been communicated to the Paris Academy.—M. Planté describes effects got with his rheostatic machine; it gives, in general, all the effects of electric machines and induction coils, and these are not apparently much interfered with by the hygrometric state of the air.—We note, among the abstracts, one of recent proceedings of the St. Petersburg Physical Society.

Atti della R. Accademia dei Lincei (Rome) 1876-77, vol. i.—This part commences with a second instalment of Prof. Respighi's memoir on the latitude of the Roman Observatory.—On fluoride of magnesium, by A. Cossa.—On the theoretical velocity of sound and the molecular velocity of gases, by A. Rieti.—Petrographical studies, by G. Struever (two plates).—On the constitution of chloral ammonia and aldehyd-ammonia, by R. Schiff.—Electrostatic researches, by P. Volpicelli.—On the microscopic aspect of certain nervous fibres, by Franz Boll (two plates).—On some palæozoic fossils of the Maritime Alps and of the Ligurian Apennines, by B. Gastaldi (four plates).—On an objection to Melloni's theory of electrostatic influence, by P. Volpicelli.—Memoir on modular equations, by H. T. Stephen Smith.—On the dilatation, the capillarity, and the viscosity of fused sulphur, by G. Pisati.—On the titanite and the apatite of the Lama dello Spedalaccio, by G. Uzielli.—On the direction of gravity at the Barberini Station on the Monte Mario, by F. Keller.—Experimental researches on the tenacity of metals at different temperatures, by G. Pisati, C. Saporito, and S. Scichilone. The author experimented with copper, steel, brass, and aluminium.—Geological investigation of the mountain group of the Gran Paradiso, by M. Baretti (with seven carefully executed maps).—Experimental researches on electric discharges, by A. Richi (five plates). This and the previous one are amongst the most elaborate papers in the volume.—On the small oscillations of a rigid and perfectly free body, by V. Cerrutti.—On the anatomy and the physiology of the retina, by Franz Boll (one plate).—Ephemerides and statistics of the River Tiber before and after the confluence with the Aniene River, during the year 1876, by A. Bettocchi.—On some cave miriapoda of France and Spain, by F. Fanzago.—On the duration of vitality in the germinative spot, by Dr. G. Colasanti.

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